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REPORT OF THE THIRD HUD NATIONAL DISTRICT HEATING AND COOLING CONFERENCE

In Cooperation with the Department of Energy
Held in Washington, DC, January 15 and 16, 1985

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CONTENTS

CONTENTS (Cont'd)

CONTENTS (Cont'd)

Introduction

Although a complex, and sometimes agonizingly-slow undertaking, creating a district heating and cooling (DHC) system can be good for cities and a good business. That is the key observation to emerge from HUD's Third Annual National District Heating and Cooling Conference held in January 1985. Much of the meeting was devoted to recounting individual experiences, by public and private system operators or developers, mayors, city staff, consultants, investment bankers, and others -- supported by federal officials from HUD, DOE, and Congress. The route from idea to reality they described has hurdles in the area of financing, regulation, community education, communication among the many actors involved, and many other areas. But rewards can be many.

City officials made the case that an operating district heating and cooling system can be a solid marketing tool for their cities, offering businesses reliability, often lower energy prices, avoidance of operating and maintenance costs and responsibilities, and sometimes freeing up space for more productive activities. It can be an answer to a serious refuse disposal problem by using waste as a fuel. It can be a source of income where revenues from a project are shared with a city or are taxed. It can help to lower air pollution. And it can cut fuel costs to public buildings -- including public or publicly-assisted housing -- and to private residences, thereby serving to support community development aims.

And the business of district heating and cooling can be profitable. A number of private operators attested to the opportunity to make money from modern DHC systems, in a variety of circumstances. These same operators pointed to strong public support as being instrumental in facilitating project development, to the mutual benefit of developer and community.

But creating a sound project financing package is complex. Limited DHC experience leaves prospective investors leery, and they require strong project guarantees. Such guarantees are often sought in the form of long-term contracts to purchase heat from such creditworthy customers as government agencies, major institutions, and substantial industries. Cogeneration (combined heat and power) projects look to electric sales contracts with utilities. Government support in the form of Urban Development Action Grants, industrial development bonds, tax deferments, and the like, also have improved project financing in a number of instances, but negotiations are often complex, demanding expert knowledge of such financing.

A recurring theme of the conference is the integral relationship of financing and project ownership. Each approach has its advantages and disadvantages appropriate to the unique circumstances of a particular project, with possibilities including for-profit companies, nonprofit corporations, cooperatives, utility owned, city owned, and various combinations of these. Cities with municipal electric utilities have found project development somewhat easier both because of financial arrangements and because central city generating plants may often provide waste heat for district heating and cooling.

Public housing projects are considered good district heating customers because of high loads, ability to enter into long-term contracts, and the system reliability benefits. Although heating costs may be lower in a district heating system as compared to conventional systems, the issue of who receives the benefits, the local housing authority or HUD, proved troublesome to a number of speakers.

Other issues to emerge from the conference included concern for the way that district heating systems are treated for federal tax purposes, the advantages and disadvantages of state utility regulations, and for cogeneration systems, the difficult task of creating an economically feasible system that can meet the purchase price and service requirements of electric utilities.

The overall tone of the conference was one of growing optimism. Expected to draw about 100 participants, total attendance was about 170, attesting to the growing interest in the subject. Although many were from the Northeast and Midwest, there was a surprising number from the South and West, often with special interest in district cooling. In contrast to prior conferences, a greater number of private developers, contractors, and system operators attended, sharing their experiences with one another, and local and federal officials.

This is a report on the conference. The meeting itself was organized around a series of topics reflecting the wide-ranging concerns of those engaged in district heating and cooling project development. This report is organized the same way.* Key points emerging from each session are indicated and a summary of each speaker's remarks is presented. Since several speakers appeared more than once, a reader wishing to know about a local project may need to refer to several sessions (See Index to Sessions, page 36).

Speakers were of several different types. Some were involved in various aspects of projects now operating -- private operators, public operators, financiers, consultants, etc. A second group consisted of those completing final work on the elements of a project. Many of these are receiving HUD "Phase II" support, i.e., engineering, institutional, and financial analysis leading to design and financing decisions. The final category includes those just beginning work on Phase II with support from HUD, sharing their initial thoughts on project components. Among audience members were representatives from some cities considering doing DHC feasibility studies, possibly with funding from a new DOE program or other sources.

It is hoped that the broad range of experiences presented here will offer instructive lessons to those contemplating developing district heating and cooling systems as part of their overall community and economic development strategy.

Principal conference organizer was Wyndham Clarke, Program Manager for District Heating in HUD's Energy Division. He was assisted by Energy Division staff members Andrew Euston, Bernard Manheimer, and Arthur Stellhorn, under the overall direction of Division Director Robert Groberg.

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*Three sessions are not reported. Sessions 1A and 1B were overviews of six DHC Phase II projects which are covered elsewhere in this report, and Session 10, Experience Exchange, was cancelled.

Welcome and Purpose

Stuart Sloame, Deputy Assistant Secretary, Department of Housing and Urban Development

In opening the conference, Sloame said that is purpose was to have cities and towns now well on their way in DHC project development share their experience with those just getting started. The former include ten DHC Phase II HUD matching-grant localities. The six "old" ones are Baltimore, MD; Provo, UT; Lawrence, MA; Springfield, MA; New York, NY; and Lewiston, ME. The four "new" ones are Chicago, San Francisco, San Jose, CA, and Hibbing, MN.

HUD considers this meeting important because it is the first of its conferences on DHC:

- that gathers cities actively working at all three phases of system implementation -- feasibility study, finance preparation, and construction -- what are termed Phases I, II and III; and

- that offers substantial evidence of Phase II progress in the creation of new systems, new ownership arrangements, new financing approaches, and new energy source-to-customer solutions. This progress goes beyond simple cogeneration, beyond conventional utility-based steam technology, and beyond the dictates of one-owner/one-user campus and institutional packaging.

This conference is considered significant to those concerned about the future of American cities and their commercial and environmental health. Modern DHC systems are now being introduced under diverse local situations. Each of these demonstrate the financial savings inherent to this mode of infrastructure investment and its flexible, multi-faceted technologies.

Above all, from the viewpoint of local government and its community development viability, this conference, according to Sloame, signals the arrival of yet one more level of public/private initiative-taking and of the expanded capacities required to accomplish local DHC packaging. Certainly these are among the most complex projects with which local governments have had to become involved.

HUD regards these newer programs as a real test of the local community development administrative capacities gained in recent years under the Community Development Block Grant and Urban Development Action Grant programs. Although a few of the DHC Phase I and II cities have met with some troublesome barriers, HUD recognizes that these DHC investments can be successfully introduced. This finding is a breakthrough -- one celebrated here by providing this major forum for technical and administrative exchange.

In his greetings, Sloame thanked his colleagues at the Department of Energy whose focus on the technology of DHC and whose cooperation has made HUD developmental follow-through matching grant activities fruitful and promising.

John Millhone, Director, Office of Building Energy Research and Development, Department of Energy

Speaking on behalf of DOE, Millhone pointed out that district heating and cooling is one of those areas in which the DOE and HUD have a natural affinity. DOE's aim is to see that energy is used as productively as possible while HUD is interested in the future of American cities. DOE's objective is ultimate energy efficiency, which means each Btu coming into a city should be used as efficiently as possible. Technical skills permit us to do that; a Btu of coal can produce electricity, hot water or steam, and the energy can be cascaded up and down. Thermal energy is a sort of secondary energy source like electricity. Electricity and thermal energy can be interwoven in exciting ways, and all of the Btus that come into a city or are generated by the city can be used and reused until we develop a capacity to be self-sustaining and reduce the drain on exterior energy sources.

DOE also recognizes the inevitability of energy becoming more and more dear. Predictions about increased use of energy have not come to pass as quickly as first thought likely. But with a fixed supply of energy resources and an increasing demand, not only in the United States but in the developing countries. It is only a question of time before energy will be more dear, higher priced, and the use of it more efficiently is going to be more and more important.

Given the long lead times necessary in order to improve the energy efficiency of cities, and with increasing energy sensitivity in the face of onrushing demand, cities will inevitably need to be far more energy efficient than they are now, according to Millhone. And district heating and cooling -- which is the principal technical method of getting efficiency out of the use of energy -- is something whose time has arrived. The only question is whether this is going to happen with intelligence and good planning.

This conference will help develop the skills that will make it possible to accelerate the trend toward increased energy efficiency in our cities, and to withstand energy price and supply shocks. These kinds of skills can be learned by talking with other people who have been involved in this process, by comparing notes with one another, and by getting new ideas on how to approach the institutional, technical, political, and economic questions that have to be resolved. Millhone closed by noting that it is this kind of information and creative idea sharing that makes it possible for all sectors and levels of government to work more effectively to bring about the needed changes.

SESSION 2A*: Use of DHC in Public Housing Modernization and its Spinoff Effects

HUD has recently issued a notice requiring local housing authorities (LHAs) to consider the economic benefits of connecting to a DHC system, where such a system exists or is planned. In addition to avoiding the cost of repairing or replacing heating plants, public housing authorities may gain such additional benefits as:

1. Reduced project maintenance costs;
2. Lower energy cost;
3. Stability of future energy cost;
4. Reduced heating labor cost; and
5. Increased energy efficiency at the projects.

Moderator Bernard Manheimer of HUD's Energy Division stressed the potential benefits, since HUD's annual energy bill now exceeds $1 billion annually. Similarly, LHAs may serve as strong "anchor" customers to a DHC system because of their often high heat requirements and their stability, which enables them to sign long-term contracts with system operators.

These mutual benefits -- of DHC to public housing, and of public housing to the economic feasibility of DHC -- were described by the several panelists.

In the three cities reporting, public housing heating systems are in need of major renovation or replacement, evoking serious interest in considering a DHC connection. With respect to Baltimore, Assistant Planning Director Sheldon Lynn described the 1,700 unit Cherry Hill project as having a heating system suffering breakdowns in recent winters. The proposed 2,200 ton per day privately-owned incinerator about two miles away seemed a natural supplier of heat, but both the prospective supplier and the Baltimore Housing Authority (BHA) were somewhat leery. The plant was designed solely to generate electricity and its owner was unconvinced of the payoffs from cogeneration. The BHA had a number of concerns, not the least of which was plant reliability, given the city's experience with a pyrolysis plant which failed even before it was brought into service. Similarly, because of HUD requirements, benefits of connecting to a DHC system are returned to HUD, not to the local housing authority.

But with city staff serving as catalyst, negotiations have proceeded; Cherry Hill's heat demand is sufficient to make the DHC project feasible even with no other customers, so the city is actively pushing the negotiations.

St. Paul is ahead of most other cities with its system operating since Fall 1984. Among its 100 customers is the 65-acre Mt. Airy project with 300 low-rise units and a high-rise community center consuming about 6 MW (thermal) of the system's 135 MW peak demand. Hans Nyman, President of St. Paul's nonprofit District Heating Development Company, described protracted negotiations with the LHA. Internal project costs totaled about $1.5 million

*Sessions 1A and 1B were status reports on the original six HUD Phase II projects. The substance of the presentations is covered in other sessions.

because of long pipe runs, heat meters, engineering services, etc. Still, the system is expected to offer a 6-10 year payback, with 1995 savings projected at $300 per unit for a total of $90,000, plus an additional $30,000 annual saving in operating and maintenance costs.

Many meetings took place with the tenants, a special problem because many are from Southeast Asia and speak little or no English.

Albany, New York, has considered a number of DHC systems, most of which would offer heat to one or more of the city's public or publicly-assisted projects. A 1981 HUD innovative grant to Albany County has been used to explore providing service to the Arbor Hill neighborhood, a community development target area, including potential service to several public or assisted housing projects on or near the initial 3-mile loop.

Originally considering using excess heat from a state heat plant, focus now is on building a wood-chip-fired plant to serve the neighborhood with heat; cogeneration, and use of refuse-derived fuels are also being explored.

One 76-unit low-rise Albany Housing Authority (AHA) project uses an oil/natural gas hydronic system which is relatively inexpensive to retrofit for connection with DHC. Another AHA project includes 238 units in steam-heated high rises and 129 units in electrically heated garden apartments. Also being evaluated is a publicly-assisted project of 260 units in all-electric buildings.

Letters of intent to connect to the DHC system have been received from the AHA and further analysis is proceeding. Savings of 45-55% over current energy costs are anticipated, due in part to low-cost plant construction and operations. Frank Hoffman, of Frank Hoffman Development Company, the county's contractor on the project, sees a high potential for success, with the likelihood of serving many smaller-multifamily units in the Arbor Hill neighborhood after the larger anchor customers are connected.

An important DHC issue with respect to public housing is sharing the costs and benefits between local housing authorities and HUD. Under current policy, a distinction is made between rate adjustments and savings through energy efficiency improvements. In the former case, HUD pays 100% of increased rates and conversely receives full benefits in the rare instances in which rates are lowered. Financial benefits of energy efficiency improvements are shared between HUD and local authorities, based on a formula. District heating is considered a rate change such that all savings accrue to HUD. Discussions are underway to have HUD consider modifying this policy to increase local incentives to connect to DHC.

A final, but crucial issue is negotiating a price for heat that saves money for the LHA and provides a needed return to the system operator. Much of the negotiation often revolves around the escalation rate of competitive fuels. In Baltimore, for example, a proposal is to tie DHC rates to electric rates (which in the Baltimore area is coal-fired), which would produce a more favorable rate over the 20-year period of the contract.

SESSION 2B: Expansion and Rejuvenation of Existing Utility-Owned DHC Systems

The conclusion from the experiences in various cities related by the panelists in this session indicates that older, downtown district heating systems can be successfully modernized and expanded as an urban energy infrastructure resource.

Many successful centrally-located steam district heating systems were put in operation in older cities in the early 1900s. A majority of these systems used rejected heat from electric power plants. As technological advances resulted in decreased transmission losses and power plants grew larger, many new base-loaded electric plants were located away from urban areas. Thus, many district heating systems lost their sources of cogenerated heat and were forced to switch to oil- and gas-fired boilers. In the 1970s, these systems, owned primarily by investor-owned electric and gas utilities, faced rising operating costs and deteriorating facilities. Many have chosen to allow the facilities to degrade rather than invest in unprofitable activities when compared to their main lines of providing electric and gas services.

These conditions have brought about a dramatic rise in rates, forcing many district heating customers to switch to individual building sources of supply. As the customer base declined, many systems are being phased out and shut down. The panel on district heating rejuvenation represents those cities, companies, and individuals who see a great opportunity for turning these systems around as a sound business activity, and a beneficial community energy asset.

Douglas Champ, District Heating Coordinator for Jamestown, New York, described a pilot DHC system, currently in its first year of operation, that was built in a period of four months. An old steam system that had used energy from the coal-fired municipal electric power plant had been abandoned years earlier. A working committee, following engineering feasibility studies funded by the New York State Energy Research and Development Authority (NYSERDA), and performed by Burns and Roe, decided to recommend building the system. For $800,000, the power plant was retrofit and hot water distribution lines were laid to serve a hospital, a manufacturer, and two municipal garages totalling 2.5 MW of thermal load. In the first year, a 30% cost reduction was achieved that has produced enthusiasm in the community for a planned expansion to 15 MW next year. Funding for the construction of the system was from general obligation bonds as part of a large sewage treatment plant issue.

An emphasis was placed on two key aspects of district heating and cooling development by William Hanselman, President of Resource Development Associates, principal consultant to Rochester, New York: (1) finding willing owners, and (2) locating potential customers in proximity to heat sources. He stressed that district heating was like a real estate development and "doing the deal" was paramount. In a competitive energy market, an entreprenurial approach is essential.

Mr. Hanselman also related from his experience that the size of the

project must suit the conditions within the community. Often projects are contemplated that are beyond the scope that the community can reasonably fund. He urged finding a doable project and moving forward without losing sight of the goal of putting it in the ground.

In the city of Rochester, Rochester Gas and Electric (RG&E) had made a business decision not to invest further in the existing system. The system was originally coal-fired, but was converted to oil and natural gas in 1973. As rates rose, customers left the system.

Several studies were made that were aimed at revitalization but none moved forward in spite of favorable conditions for maintaining the system. Finally, a decision was made to make a first attempt with funding provided by the NYSERDA. Since RG&E was not a willing owner, a working group of key customers and the city was formed to direct the assessment. While the study has been progressing, the working group has organized itself into a cooperative with the intent of purchasing the system from RG&E and becoming the operating agent. The work is still proceeding and a system configuration and purchase agreements have not yet been finalized.

One of the most successful companies in rejuvenating downtown steam systems is Youngstown Thermal, a private venture company. President Carl Avers related that in 1979 steam rates in Youngstown, Ohio were $14.50 per MMBtu when his company bought the system. Today steam rates are $8.00 per MMBtu and steam sales have tripled. Youngstown Thermal believes groups of buildings are more cost-effectively heated and cooled from one central source because of the inherent economic and efficiency advantages of DHC. Groups of buildings under common ownership such as hospitals, universities, and military bases are commonly district heated and cooled. Most often, it is the divergence of interests and a lack of unifying force that prevents other groups of buildings from enjoying these benefits. Youngstown Thermal is in the business of joining different interests together to enjoy the common benefits of DHC systems.

Youngstown Thermal, which has recently formed Thermal Resources of St. Louis, has purchased the downtown St. Louis steam system from Union Electric. The electric utility wanted out of the district heating business to focus exclusively on electric service, their main line of business activity. The public utility commission cooperated with the city and Thermal Resources by allowing expansion of the franchise service area, which now serves 266 customers. Thermal Resources hopes to double or triple steam sales in the near future through an aggressive marketing program. The system is oil-fired now, but with city cooperation, planning is underway to convert to an all coal- and solid waste-fired system.

In San Francisco, Pacific Gas and Electric (PG&E) is a combined utility which decided to stay in the district heating business rather than abandon it. The city, with a grant from DOE through the Urban Consortium Energy Task Force, made a feasibility study of PG&E's downtown steam system and the nearby city-owned system serving municipal buildings. The systems are old, have no condensate return line, and are in a general state of decline. John Fox, manager of PG&E's system, indicated the study showed that by linking the two systems, district heating

could be returned to profitability. Through a phased expansion, DHC could also be a significant tool for economic development and redevelopment in the downtown area. The city has recognized the value of the system and is providing active support as the recipient of a HUD funded Phase II feasibility study grant. The potential exists to expand the DHC market through infilling of existing areas, improving manpower and fuel utilization to reduce costs, and developing cogeneration as a heat source. PG&E, which expects profitability by 1987, believes that by staying in the district heating business and providing customers with an array of energy options, all interests will be better served.

SESSION 3: The Congressional Perspective

Martin O. Sabo, U.S. House of Representatives (MN), Appropriations Committee, Subcommittee on HUD and Independent Agencies

In brief remarks, Rep. Sabo indicated that the federal government has not yet fully resolved the question of how district heating and cooling systems should be treated. On the one hand there are those who see the federal government as serving a more active partnership role with state and local governments and the private sector on researching and developing alternative resources and promoting increased energy efficiency. On the other side are those taking a hands-off approach, even, given tight budget circumstances, cutting research and development.

Greater federal activity over the short term seems unlikely given the size of budget deficits, the lack of current energy crisis, and huge trade imbalances. While the issues remain controversial, Rep. Sabo believes that federal support for research and development in new and renewable energy technologies, including DHC, will continue.

He expressed skepticism over the likelihood that new loan guarantees or other direct support programs would emerge from the Congress, since the federal budget already has high loan obligations. One possibility, however, is to look at the available Synthetic Fuels Corporation funds for loan guarantees.

SESSION 4A: Marketing to Anchor Customers

The key to a successful district heating and cooling program is the development of anchor customers early in the system development process. This was the conclusion from the experiences of the panelists in this session. Anchor customers not only want to know what potential energy and cost savings might be, but also what risks they may face. The DHC system developer and financing community want adequate guarantees of returns on investment to maintain viable operations and meet debt service. Therefore, both the developer and potential anchor customers must participate cooperatively early in the development process and to mutually share in the decisions as the project proceeds.

Peter Dekker, Manager of the City of Holland, Michigan Municipal Electric System, described the process of supplying steam and hot water to two industrial plants and Hope College. He emphasized the need to focus on a small project to start, particularly if the city has no prior DHC experience, as is the case in Holland. The major potential customers were represented on the assessment work group of the Phase I HUD funded study that determined district heating would be beneficial in Holland. The anchor loads, particularly the college, wanted more detailed engineering evaluation of how the system would interface with its buildings. Therefore, a second more detailed study was commissioned financed by the city and cost-shared by the college. This study verified that energy savings were possible and the project is now expected to proceed to construction. Dekker stressed that success in Holland was possible only through the close working relationship of the city with its potential anchor customers. He expects no difficulty in expanding the system to serve other loads once the core project is operating.

A one-on-one working relationship with potential anchor customers is necessary to convince them the system will be economical and reliable. This has been the experience of Joseph Superneau, Deputy Director of the Springfield, Massachusetts Department of Public Works. The city of Springfield initiated DHC development under a Phase I HUD assessment grant and is continuing its program under HUD Phase II. Initially conceived as a market for thermal energy from a solid waste plant, a major potential benefit from DHC is now seen as lowering the first costs of a new $100M hotel/office/commercial complex being planned for downtown Springfield. Therefore, the city is planning on initiating the first phase district heating system to downtown customers with a gas-fired hot water system before the waste-to-energy plant is on line to capture the downtown heating load.

To achieve credibility with downtown building owners, the city has worked closely with the Springfield Central Corporation, a nonprofit organization that has been successful in bringing about major revitalization in the city core. Most of the downtown building customers are members of Springfield Central's board of directors and initial marketing meetings have been arranged through them. A second key aspect to credibility in Springfield has been to assemble a team with the necessary technical skills to present workable options to building owners. The technical team prepares on-site engineering and economic evaluations of existing building equipment and analyzes

retrofit potential. Those buildings with minimal retrofit costs are targeted as potential customers. An initial service area of twelve buildings has been identified.

It is the second time around for the Chicago Stockyards DHC project, and sometimes lack of success is the best teacher. Fred Roland, President of Roland, Clark and Associates, consulting engineers, described what did not work on the first attempt five years ago and what he hopes will work now to bring a solid waste-fired district heating system on line. The system will serve several major industrial customers now located in the old Stockyards area of Chicago's Near South Side.

The original project had worked out an agreement in principal with a major customer, but subsequently experienced unanticipated delays and added requirements in securing financing. The lesson to be learned here, according to Roland, is to proceed with a financing framework and customer marketing in parallel steps. The new project, resurrected through a partnership of city and private developer interests, plans to approach customers with a staged concept including options, letters of intent, agreements, etc. as the project proceeds.

Another important ingredient in the new approach is marketing to individual customers through the Back-of-the-Yards Council, which represents industrial interests in the area. The support of the Council, the City of Chicago, and the Federal government through a Phase II feasibility grant, has generated the interest of 20-25 potential customers. The key to marketing, Roland feels, is to prepare an on-site technical evaluation of customer needs, and then to proceed with a flexible development strategy with the customers involved along the way. Continued communication and agreements with the customers is necessary because adjustments will be necessary as the DHC development process proceeds.

DHC marketing from the viewpoint of a large combined utility, Pacific Gas and Electric, was presented by John Fox, Manager of PG&E's San Francisco steam system. While large utilities have an advantage in credibility and data base for existing systems, they don't get involved in the planning and development process early enough to supply the customer with a DHC option for new construction. PG&E is six months into a turn-around program on their downtown San Francisco steam system as a result of city support and a Phase II HUD feasibility grant, so marketing experience is limited. However, planned expansion into nearby redevelopment areas has resulted in working with technical groups to be sure customers know the technical requirements of DHC services. PG&E is working cooperatively with the city in approaching new development interests with the DHC option.

One aspect of marketing DHC services from the regulated utility perspective is the lack of experience in long-term negotiated contracts. Both the utility and the public utility commission, which have little experience in this regard, will have to respond to market-driven opportunities and a different risk-reward structure than they have in the past. While a long-term contract can be negotiated, it may take an unacceptable length of time to be approved through the routine company and PUC channels. Some new ground will have to be broken in this area, Fox believes.

SESSION 4B: Financing Alternatives

The difficulty of configuring a financeable project was a thread running through the entire conference, and was the focus of five experts at this session. The complexity of financing issues, the number of variables that must be considered, the uniqueness of each project -- all were stressed, with the concurrent recognition of the need for early, sound financial advice (even though such advice is expensive). Project ownership is integrally linked with financing alternatives, especially the issues of forms of public vs. private ownership and how project revenues are apportioned.

The difficulties of creating a feasible cogenerating system were discussed by Robert Faunce, Planning Director of Lewiston, Maine. Though intended to generate low-cost, wood and refuse-fired heat to improve the competitiveness of downtown mills and to cut energy costs in the adjacent Little Canada neighborhood, about 90% of project revenues would be derived from sales of cogenerated electricity to the Maine Power Company. Meeting the avoided cost rates and service requirements of the power company offerings has been difficult. When considering income, project staff and consultants have had to balance thermal and electric revenues, while keeping thermal energy prices below that of competing fuels. To do so has required many iterations of alternative fuel mixes, plant designs, piping networks, and other factors particularly because both heat and electrical demand peak in the winter requiring some equipment redundancies.

An offer made by Lewiston to Maine Power in November 1984, would provide 15 MW electricity at an average price of 11.5¢ kW. If accepted, the city would move into intensive negotiations to purchase refuse from nearby towns, and for a contract for ash disposal in a certified landfill (such ash is considered a toxic waste in Maine).

Throughout the extensive study and analysis process, prospective customers have retained a strong interest, including the possibility of participating in project financing.

Lawrence, Massachusetts, can be considered a scaled-up version of Lewiston. Both are typical New England mill cities whose rivers supplied direct hydropower in the 19th century. After a period of recent decline, some industrial rebirth is occurring, with energy costs a prime factor. Lawrence, however, has a head start over Lewiston. A privately-owned, $100 million resource recovery system is now operating, collecting refuse from several towns, and converting it into electricity for sale to the New England Power Company, and to steam. A 1.5 mile line, just coming into service, will provide steam to two public housing projects and to the Merrimack Paper Company.

Two expansion possibilities are being investigated with support from HUD's Phase II program. One would extend the existing steam line to other industries in the North Canal Industrial Area (NCIA) abutting downtown and to Lawrence General Hospital, and the other would serve the low- and moderate-income Arlington Neighborhood, close to the powerhouse.

Stanley Twarog, of Mintz, Levin, Lawrence consultants, described financing alternatives being considered for the two projects.

The NCIA is likely to use conventional financing, with a debt to equity ratio of about 4:1. Equity may come from the two banks that own the existing cogeneration systems; the system operator, Refuse Fuels Associates (RFA); or a new vendor that has expressed interest in some combination of financing, ownership, or operations. Contracts with prospective customers are now being developed to assure a revenue stream with sufficient certainty to satisfy investors.

Financing the Arlington Neighborhood project will be more challenging. In this dense area of 2,400 3-6 flat frame dwellings, property owners have little capital to finance either distribution or in-building retrofits. With weatherization, costs to service the entire neighborhood could reach $18 million.

Because of community apprehension, a 3-phase process is being considered. The first step would include a small DHC demonstration involving weatherizing, retrofitting, and providing district heat from a packaged plant to a few buildings. City and RFA funds, supplemented by repayments of existing UDAGs, may be used to finance this phase.

In a second phase, a larger number of buildings would be serviced by a pipeline from the powerplant. The built-out system would cover the entire neighborhood, financed by a combination of UDAGs, weatherization funds, loan paybacks from the existing system, and other sources. Initial calculations appear to indicate that the revenue stream would be sufficient to cover loan repayments. Ownership would be in the hands of a new nonprofit community corporation, although a private vendor is considering participating.

New York City's Phase II project is looking at cogeneration in the Brooklyn Navy Yard (BNY), now a city-owned industrial park. The internal distribution system had been supplied by a utility company for many years; it has temporarily been replaced by on-site boilers. The distribution system itself is old and leaky, with major repairs and renovation anticipated. The new system being considered could substantially improve the attractiveness of the BNY to new industries by supplying lower cost heat and electricity. Total cost is estimated at approximately $40 million.

Service to 5,000 nearby public housing units and a large sewage treatment plant now under construction, also is part of the planning.

A number of financing/ownership options have been considered and evaluated against the dual criteria of lowering energy costs, and minimizing or (preferably) eliminating the city government's financial risk.

As presented by Richard Kuo of the New York City Energy Office, the three alternatives that have been considered include:

(1) Full public debt financing through revenue bonds issued by city and state agencies, plus UDAG support. The Brooklyn Navy Yard Development Corporation, the nonprofit BNY manager, would own and receive all revenues for investment in the Yard's infrastructure.

(2) Municipal lease-financing. The city would be the direct borrower, lease the system to a private contractor/operator, and would gain ownership at the end of the installment period. Installments would be paid

by the city through annual appropriations, with revenues intended to meet or exceed payments. A UDAG is not possible under this arrangement because no private funds are at risk.

(3) Combination of private tax equity, tax-exempt debt, UDAG, and private corporate guarantees. The system would be privately-owned, with revenues, to be negotiated, shared by the city and the vendor. Feasibility is dependent on: long-term heat/electrical purchase contracts; strong credit support; investment grade ratings for bonds; security for taxable debt; and UDAG approval.

The third alternative is preferred because it best meets the criteria. Remaining uncertainties include analysis of the effects of the 1984 Tax Reform Act, approval of a UDAG, revenue sharing negotiations with the prospective vendor, final project designs, and, of course, contract negotiations with potential customers.

Provo's project director Garth Limburg pointed to the attractiveness of a municipal utility in financing a district heating system. Although not eligible for UDAG because no private capital is at risk, municipal utilities may simplify the decision-making process, have fewer regulatory barriers, and offer a better financial track record than other ownership alternatives.

After rejecting an initially proposed $45 million project as too grandiose, attention settled on a start-up system using waste heat from Provo City Power's downtown coal-fired power plant. Customers include two hospitals, a high school, a recreation center, elderly housing, and other nearby buildings. Provo City Council approved the project in October 1984.

Banker Alan Cohn, of New York City's Matthews and Wright, described how financing was arranged following the city's decision to proceed with the initial $1.5 million system. A complicated mechanism called advance refunding was used. Under this approach, old debt is restructured to make funds available for new projects. In Provo, $22 million remained outstanding on a 1980 revenue bond issue to cover part of the cost of a new power plant. Under the advance refunding plan, the city has issued $22 million in new bonds. These funds were used to purchase special U.S. Treasury instruments. In turn, these paid off the existing principal and interest, effectively wiping the old debt off the books. Concurrently, the city purchased an insurance policy to protect bond holders against default. Because the $22 million now was secured by an insurance policy, an existing $2.25 million debt service reserve fund (required by rating agencies for revenue bonds) was no longer needed. It was the city's decision to use part of these newly-freed-up funds to finance the DHC project, to be paid back from project revenues. A side benefit was the virtual elimination of all costs of issuance, except for a small amount of city staff time.

With financing now in hand, construction should begin soon, with startup projected for October 1985. Plans are already underway to expand to the central business district and to use municipal refuse as a supplemental fuel.

By contrast, the Trenton system is owned and operated by a private, for-profit corporation. As reported by Thomas Casten, President of Trenton's

Cogeneration Development Corporation, the cogeneration system has been financed by a mix of public and private sources, including a UDAG.

The $32 million project is serving several city and state buildings in downtown Trenton, with expansion plans being made. Ground was broken in April 1983; service began in late 1984. Lacking a "deep pocket," financing has been very complex. Public building and hospital steam purchase contracts, the electrical sales contract with the private utility, and a $4 million UDAG, provided the necessary investor guarantees, Financing consisted of $14.1 million in bonds issued by the New Jersey Economic Development Authority, $12.5 million in leveraged equipment lease financing, the UDAG (with repayment subordinated to bond and lease payments), $1 million in corporate equity, and about $0.4 million in study and start-up costs from DOE.

This unique package was put together by Prudential-Bache.

Casten derived several lessons from the process:

1. Financeability was dependent on solid steam and electricity sales contracts with creditworthy customers, and strong support from the state's Public Utility Commission.

2. UDAG support substantially reduced the risk to private capital, acting effectively as project equity.

3. Capital budgets are extremely difficult to estimate, and should be very conservative because of hard-to-foresee costs.

4. Blending public and private financing involves high transaction costs and involves educating financiers who typically are specialists.

5. Government cooperation, is a sine qua non; in Trenton, ready access to the Mayor and other government officials was essential to help with permitting, financing, and other decisions.

6. Success is contingent on operating as well as financing commitment. DHC operating skills are scarce; the system should operate like any other utility in its provision of an essential service.

In sum, DHC still considered to be in its infancy in this country, appears to demand stronger guarantees (lower risk) than other large ventures to satisfy prospective investors, a situation that is expected to change as investors gain more experience from projects such as those in the HUD program. To date, projects usually have needed some infusion of public funds, such as Urban Development Action Grants, HUD or DOE innovative or demonstration grants, proceeds of state or city bonding programs, etc., and, critically, long-term contracts offering low-risk to customer. Public buildings are considered prime customers because of their stability, creditworthiness, and ability to sign long-term contracts.

SESSION 5: DHC as a Community and Economic Development Tool for Your City

The six speakers at this session include a mix of public officials and private system developers or operators, each of whom stressed the linkage of district heating and cooling to community and economic development. Community interest in DHC results from its potential to improve housing and industrial competitiveness through lower energy costs. Business people also stressed the community linkage, while pointing out that DHC also can be a good business.

Chicago's citywide analysis of district heating potential has centered on the old Union Stockyards, now an important industrial area. Some of the companies may be marginal; DH may help improve their financial position, and be included among the available package of incentives to attract new industries.

The proposed privately-operated system would contract with the city for refuse to fuel a cogeneration system. In addition to capital improvements already made, the area is a state enterprise zone which entitles industries to a number of state tax and regulatory benefits. Other incentives available include access to city industrial revenue bonds, below market rate revolving loans, SBA financing, land-cost writedowns, and property tax relief.

In his presentation, Project Manager Charles Williams of the Department of Planning, noted that the city is convinced of the benefits to its development of DHC, and sees the Stockyards project as demonstrating its potential to other areas of the city.

Provo's first phase project, presented by Garth Limburg, will serve mostly public and residential buildings in the immediate vicinity of the municipal power plant. Later expansion, particularly to the central business district, will enable downtown retailers to be more competitive with suburban and fringe area businesses. Interest in DHC service has also been expressed by owners of a hotel and an office building on the edge of the central business district.

An additional expansion opportunity exists in the city's south end. The East Bay Business and Research Park is a city-controlled 428-acre development abutting a sewage treatment plant. Preliminary studies are assessing use of treated plant effluent as a heat source, boosting its temperature to provide heat to business park customers. Low city electric rates may enable use of electric heat pumps. The resulting low-cost heat could improve the Park's marketing position and all utility services would be from a single source.

Eventually, the downtown and business park systems could be connected, serving a large part of the city.

As pointed out by David Rubin of San Francisco's Planning Department, that city's situation differs from most northeastern and midwestern cities in two important ways. Suffering from development pressure rather than decline, DHC is seen more as a tool to promote energy efficiency than as incentive to business. Second, its interest is more in cooling than in heating.

Its current study is considering combining a city-owned system serving public buildings with a Pacific Gas and Electric system serving the downtown core, and whether the system can be expanded. Expansion plans focus on Yerba Buena Center, a renewal area adjacent to downtown including a hotel, offices, and housing. Also being looked at is a nearby office development.

The Planning Department is considering offering a density bonus to developers as an incentive to connecting to the DH system.

Springfield, Massachusetts, also is looking to DHC as a component of its development strategy. Springfield's downtown has undergone an extraordinary revitalization in the last few years, after a long period of decline. District heating is seen as offering developers, who often consider first costs of a project rather than life cycle costs, an alternative to electricity. According to Joseph Superneau of the Public Works Department, the city's study will look beyond downtown to the potential for serving residential neighborhoods, as well.

Developer David Carley of Washington, D.C., brought a different perspective to the discussion by stressing the linkage between good business and community benefits. He identified several factors that create a feasible project:

1. A market for the product; people with disposable income.
2. Financing available to cover production and maintenance.
3. Meeting environmental and other regulations.
4. A high quality political and social setting.
5. Potential to withstand adverse future risk.

These characteristics also hold true for district heating projects. Other DHC benefits include job creation, particularly for people with limited skills; reduction of energy costs and stabilization of supply; improved environmental quality; and promotion of economic growth.

From his experience, Carley added several caveats:

1. Financial disincentives to district heating need to be removed, including equalizing its tax treatment.
2. Technical, legal, and regulatory assistance to government, prospective customers, and developers, should expand. Current knowledge is poor.
3. Regulatory barriers should be removed.

Final thoughts were offered by Anthony Mirabella, operator of the oldest commercial steam system in the country. He attributed the success of the Hartford Steam Company to strong cooperation and support from the city, developer, engineering firms, and financial institutions.

Since its inception in 1962, HSC has grown to serve a number of customers in downtown Hartford, including the Civic Center, with both heating and cooling. Customers benefit through a 22% savings in energy costs; the balanced heating and cooling load provides a consistent revenue stream of about $1 million per month.

The following benefits of DHC can be seen from the long experience in Hartford: fuel flexibility; backup capability providing reliability; reduced operating and maintenance costs; more productive use of available space; higher air quality; and integration potential by using solid waste or methane for fuel.

Supporting Carley's earlier comments, DHC is considered good for the community and a good business opportunity.

SESSION 6A Waste-to-Energy Systems as an Element of a Community Development Program

When a waste-to-energy system is contemplated as a source for a district heating and cooling system, phasing can be a complex process. For large cities contemplating a large waste-to-energy system, development of the project can take five to seven years. Smaller projects with modular package units can be completed in a three to four year time frame. Typically, DHC markets start small with a few anchor customers and than grows. Coupling a DHC system with a waste-to-energy source can add implications because of the many associated legal, contractual, economic and siting issues. An alternative source of heat energy may be required to get the DHC system started until the waste-to-energy system is in operation. In spite of the phasing problem, the panelists concluded that waste-to-energy systems and DHC systems are an ideal match. The waste is an inexpensive renewable resource, and the DHC system provides a ready market for the energy output of the waste plant.

Carl Marietta, Public Works Director in Hibbing, Minnesota, described a novel twist to coupling waste-to-energy with economic development in his community. Because of the economic downturn in the steel industry, the Minnesota Iron Range is experiencing severe unemployment. To diversify the economic base, the Iron Range Rehabilitation and Resources Board (IRRRB), a state agency, selected Hibbing as the site for a developing forest products industry. Wood Park, an integrated forest products industrial park, is being developed by the city of Hibbing in cooperation with the IRRRB.

In addition to various financial incentives for occupants of the park, the City Utilities Commission is providing all services including steam from its existing district heating system. Rates for steam, which must be used where applicable, are established tariffs for small customers and negotiated contracts for large customers with a steam requirement greater than 5000 lb/hr. The novel feature of this arrangement is that the city is adding the capacity to burn up to 160,000 tons per year of wood residue generated by occupants of the park in its municipal coal-fired cogeneration plant. The first occupant of Wood Park is scheduled to be a chopsticks manufacturer.

The importance of financing the waste-to-energy system was stressed by Joseph Superneau, Deputy Director of Public Works in Springfield, Massachusetts. Springfield is in the final stages of developing a 300 ton per day waste-to-energy facility that will cogenerate electricity for sale to the local investor-owned utility and heat for a planned downtown district heating and cooling system. The city has issued tax-exempt revenue bonds to finance most of the cost of development on behalf of a private full service vendor. Superneau advises retaining a financial advisor early and keeping financial feasibility in mind throughout the development process.

Superneau stated that waste-to-energy system development requires balancing of electric and heat rates, tipping fees, and developer profit. Negotiating the sale of electricity to an

investor-owned utility can be time consuming and difficult since utilities want guaranteed delivery over long periods of time. It is best to negotiate a long term contract for electric sales rather than adopt PURPA rates to get higher early year rates and keep tipping fees as low as possible.

John Merrill, of the Northeast Maryland Waste Disposal Authority, described Baltimore's experience in developing a large (2250 ton per day) Southwest Refuse Disposal Facility. There were three driving forces behind development of the system: (1) acute lack of landfill space; (2) concern over the environmental quality of existing landfills; and (3) rising energy costs. The first force is overriding because without it a system probably will not get built.

The critical increments of a successful project are: (1) a long-term reliable waste supply normally provided by local government; (2) a private sector partner with proven technology; and (3) a long-term and dependable energy market. Since waste-to-energy facilities are capital intensive, energy revenues are required to keep tipping fees competitive.

In Baltimore, the original concept was to build a heat-only refuse-fired boiler plant at the Southwest site to supply steam to the downtown district heating system. A pipeline already existed since the facility was built on the site of a former pyrolysis plant. However, Baltimore Gas and Electric (BG&E), then owners of the steam system, decided they did not want to continue in the district heating business and offered an unattractively low price for the steam output of the refuse plant. Normally, economics favor heat sales to electric sales by a factor of 2 to 1 because of the inherent efficiency advantages. The low offer price for steam forced the plant design to include a 60 MW steam turbine generator to provide for electric sales. Since the city knew that a thermal market existed, however, the flexibility for heat generation through steam extraction from the turbine was retained in the design. Subsequently, Youngstown Thermal Corporation bought the downtown steam system from BG&E, and negotiated an acceptable price for steam to purchase 1400 billion Btu per year from the Southwest facility. Keeping options open through the flexibility of DHC has resulted in a good marriage of interests and a sharing of benefits The system provides a ready thermal market for the waste facility; conversely, the waste facility provides a cheaper source of energy for the DHC system than the oil- and gas-fired boilers now being used.

The move to combine heat and power generation has also paid off in a second thermal market targeted in the Cherry Hill area located within one mile of the Southwest refuse plant. Plans called for serving a public housing authority complex, several stores, and a hospital with 180 billion Btu of heat energy per year with expansion capacities to double the amount. The $9 million financing to build a hot water transmission line to serve the area will be done privately by Signal-Resco, owners and operators of the Southwest facility. Merrill concluded that the flexibility of providing both electricity and steam is an ideal combination that results in year around utilization of the plant, a requirement for a waste disposal facility.

Charles Williams, of the Chicago Planning Department, commented that the logic of waste-to-energy system

development should be reversed. Rather than thinking in terms of developing a facility and then finding markets for the thermal energy output, cities should think of targeting and developing thermal markets which can be served with future district heating and cooling systems. One attractive source for the DHC system then becomes a waste-to-energy facility.

Walter Jabzanka, consultant to , Lawrence, Massachusetts, echoed this theme and pushed it a step further. He suggests that there may be inherent conflicts between community development objectives and the resource recovery profit motives of the system developer. Some adjustments in project concept may have to be made to accommodate the broader social and economic objectives of the community. The city can play a critical role in shaping the district heating side of the project to serve, for example, marginal industries or low income neighborhoods.

District heating is underway in Lawrence with steam supplied by a cogeneration power plant burning refuse-derived fuel. It serves industry in the city and plans are being made to serve a low-income neighborhood. DHC development in Lawrence has been spurred by HUD Phase I and Phase II grants and a UDAG. The UDAG must be repaid by the private developer, Refuse Fuels Associates, and can then be used by the city for community development projects. In addition, the city also has negotiated a share in the annual profits of the resource recovery and district heating facilities. Thus, Lawrence stands to benefit in many ways from the waste-to-energy resource system that resulted from public and private partnership efforts.

Moderator David Gatton, Research Director of the U.S. Conference of Mayors, summarized the session by concluding that a thermal market not only makes economic sense but also has greater development impact on the community because it focuses the benefits in neighborhoods, industrial parks, and downtown areas. While tipping fees may be influenced in the near term by electrical sales, the city may have to take a longer-term view of developing a DHC system as a thermal market for energy produced by the facility. Tradeoffs in near term economics may have to be made to realize long term benefits. A natural role for the city is to begin development of a DHC system rather than wait the necessary time before a waste-to-energy system may come on line. Then the DHC system, because it is a flexible source approach, can switch to refuse waste-fired energy at a later time. In this way, the thermal market is ready and waiting when the waste facility goes on stream.

Since waste-to-energy facilities are difficult to site, Gatton believes they are more easily sold in combination with an industrial park. Then the community thinks industrial base rather than landfill. Also, host community fees in lieu of taxes may be negotiated and the community in which the facility is sited can then use this as economic development funds. However it is done, the panelists concluded that a district heating system coupled to a waste-to-energy facility as a heat source can be a significant part of a community's economic development strategy.

SESSION 6B Ownership Alternatives and Their Significance

In structuring a DHC deal, questions of who should own the system usually emerge from a range of prior considerations studied in the feasibility analysis process. As outlined by moderator Richard Zelinski of Public Technology, Inc., these prior considerations are:

1. Service and economics: Are high short-term capital costs outweighed by long-term service benefits and revenues; are there positive developmental effects?

2. Market: Are there prospective customers; can the density support DHC?

3. Environmental impacts: Are overall effects positive compared to existing systems?

4. Risk: Who takes how much risk, i.e., financial, operating, long-term liability (if system fails to meet expectations); is risk manageable?

5. Financing: This is directly linked to risk; return is usually proportionate to degree of risk.

Since energy production is generally a new role for cities, cities are wary about system ownership. The panel presented a range of ownership arrangements existing or under consideration, including private owner-operator; public owner-operator where there is no existing municipal electric utility and where there is; cooperative owner with a contracted operator; and local authority owner-operator. Reasons for following these approaches are described.

Under a HUD Phase II grant, San Jose currently is completing studies of a cooling system that would serve a convention center and hotel complex now under construction, and an existing city library. Expansion opportunities exist in adjoining blocks. The cogeneration system looks promising and is receiving support by customers and by Pacific Gas and Electric which is seeking more generating capacity. The $1.5-$2 million project shows a possible 4.7 year payback (compared with the $.5 million cost of a conventional system).

City Energy Manager Rita Norton and consultant Steve Schiller of Impell Associates, outlined the alternative ownership arrangements under consideration.

1. The city retains full ownership through its redevelopment agency. Customers would pay rates based on operating and capital costs, likely to be less than or equal to current heating/cooling/electricity costs. Customer benefits include saving space and operating costs and possibly energy cost savings. Benefits to the city include maximizing profit and encouragement of development.

2. City ownership, with customers investing based on their avoided capital cost. Customer benefits are the same as alternative no. 1, based on a return on their investment; the city would also receive revenue benefits, although probably lower than alternative no. 1.

3. A variation on no. 2 would involve a city-customer partnership, with a more equal sharing of risks and potential profits.

Criteria for deciding which alternative to choose include: (1) how much profit does each party, including the city, want to receive; (2) what are potential development incentives of the system (probably the most important to the city); (3) are customers willing to share risks and benefits; can the city compel participation; (4) can system construction be tied to convention center construction schedule; and (5) can a long-term ownership/financing model be created as a successful model for future projects.

A decision will likely be made in the immediate future, to concur with current construction plans.

An existing downtown Pittsburgh system has been suffering the plight of many utility-owned systems: conversion in the 1960s to fuel oil and subsequent price increases led to loss of customers, further increases, lack of investment capital, and system deterioration. With the city as a major customer, and serving as intermediary, customers considered abandonment or alternative ownership. As reported by George Whitmer of the Mayor's Office, the city rejected any form of ownership as too risky, financially and politically. An independent body can make service extension and cutoff decisions on economic grounds that may be too controversial for a public body. Similarly, the use of resource recovery as an alternate steam source was rejected because low area tipping fees made it economically unattractive.

Agreement finally has been reached by remaining customers to create a not-for-profit cooperative to take over ownership, with a 10-year steam purchase agreement. The board consists of customers including city and county officials, and private building owners. A $7 million industrial development bond has been issued to purchase new boilers and for major system renovation in hopes of attracting previous customers back.

Douglas Champ of Jamestown, New York's Department of Development, described the process leading to a decision to use waste heat from a city coal-fired generating plant to fuel a pilot hot water DH system. In a study begun in 1981, several ownership options were considered. Although private ownership was considered because of greater flexibility in raising funds, the decision was made to retain ownership in the city's existing municipal electric utility because of fewer regulatory constraints, the solid financial base, and the ability to get the system up and going quickly.

The presentation of the Lawrence project covered ownership characteristics of the existing waste-to-energy system, and alternatives being considered for the two expansion lines. Presentations were made by Jay Campbell and Bonnie Mitchell, of HDR, consultants to the Lawrence project.

Ownership of the present system was virtually predetermined by its having been added to an electricity-generating waste-to-energy system under private development at the time. Cogeneration opportunities emerged from the HUD-sponsored feasibility study, and the ready willingness of the developer, Refuse Fuels Associates, to add a steam line to the already-planned electricity generation plant. A key factor was the limited number of customers to be served by district heating.

Extension of the steam line to serve several mills in the North Canal

Industrial Area and the Lawrence General Hospital is now being considered. RFA may continue to own depending on financial considerations. Alternatively, a private vendor has expressed interest in participating as contractor, financier, or owner. Discussions are continuing.

Expansion into the residential Arlington Neighborhood is more complicated, with current thinking tending toward creation of a community-based not-for-profit corporation that would own the distribution system, purchase energy from RFA, and retail to customers. It might also provide weatherization services. Community interest has been strong, and work may proceed on a small pilot project.

These case histories exemplify the range of possible ownership alternatives, and the care that must be taken in designing the approach most appropriate for each city.

SESSION 7: Private Sector Perspective on Partnership with Cities

This session brought together five private developer/operators of district heating systems all of whom, perhaps surprisingly, testified to the strong support their businesses had received from government officials, and the continuing need for private/public collaboration to help make district heating successful.

Tom Casten of Trenton's District Heating Development Company averred that because of the untraditional nature of district heating development, access to top government officials, particularly in city government, is crucial. Lessons from the Trenton experience are:

1. Ready access to top city officials can help cut red tape, saving developers time and money. In Trenton, for example, a blanket street opening permit was received, avoiding layers of approvals each time a pipe needed to cross a public way.

2. Cities are good credit risks; they are stable and usually creditworthy. Jails are particularly good customers. Federal building contracts may even be more desirable, but have been hard to obtain.

3. Existing rules do not cover DHC. Getting rules changed is facilitated where one body, e.g., a city, advocates with another, e.g., a state PUC. Similarly important is mayoral support which enabled such decisions as zoning, a UDAG application, building permits, etc. to readily pass the city council.

His advice is to:

-- Try to avoid normal business/government distrust by maintaining openness and honesty.

-- Try to avoid politicizing the issues.

-- Seek and maintain ready access to top officials.

Although at a much earlier development stage, a Chicago developer, Thomas Masbaum of Stockyards Energy Recovery Associates, reports a good experience with the city of Chicago. Although his firm's initial efforts to create a Stockyards DHC system failed about five years ago, a close relationship with city staff has helped a current project move forward. Particular efforts have been made to keep politics out of the process, and make reciprocal offers of assistance. City staff, for example, conducted a well-attended seminar on DH for Stockyards area businesses as an educational/early marketing device. They have jointly developed a list of issues to be resolved to bring the project to fruition. A good deal of information transfer has occurred, with Planning Department staff obtaining and making available information and material to move the project along, considered by Masbaum to be very beneficial.

In Rochester, New York, the Rochester Thermal Cooperative was formed just last November, after the now-familiar process of deterioration had occurred with an existing utility-owned DH system. With the city as

catalyst/facilitator/organizer, a series of studies was done leading to the creation of the Coop. Additional strong support has come from Monroe County, New York State Energy Research and Development Authority, the Chamber of Commerce, and present system users.

Coop President, Armand Lartigue of Xerox Corporation, sees several factors supporting a strong government role in district heating:

1. Credibility: City and county were key catalysts bringing the parties together and managing the transition.

2. Customer base: City and county buildings anchor the system with about 50% of the load.

3. Financing: Knowledge of and access to grants, low-cost loans, etc., enabled creation of a sound and successful financial plan.

4. Taxes: Government has incentive to maintain the system and its tax revenues.

5. Deregulation: Government supported system deregulation.

6. Resources: Government officials brought expertise in engineering, finance, real estate, codes, and administration.

In summary, government is in a good position to expedite cooperative ventures that support community/ economic development through reliable district heating.

A mutually-supportive business/ city relationship was also reported by Jay Campbell, consultant to Lawrence and Refuse Fuels Associates. RFA's initial idea to create a refuse-to-electricity system was greeted enthusiastically by city officials, then Mayor Lawrence LaFebre, in particular, when announced about four years ago. It was seen as a solution to the escalating municipal refuse problem. Emergence of district heating as an additional output generated even greater interest, with its potential for supporting the city's industrial and job base.

City support included the original HUD study of district heating feasibility, application for a UDAG, community education, and strong marketing assistance, including contracting for steam purchase by the Housing Authority.

Support and commitment continue, with Phase II system expansion studies now being completed. Such proprietary interest, according to Campbell, can be a key to a successful and mutually-beneficial project.

Finally, Carl Avers reported on a St. Louis experience parallel in many ways to Rochester. With strong mayoral leadership, the city stepped in to develop a plan to rescue a failing DH steam system. Advice from a HUD-funded U.S. Conference of Mayors technical assistance team was sought and subsequently accepted. That plan is now being implemented.

As in Rochester, the city had a number of reasons to keep the system going: city buildings were customers and system failure would require costly replacement; a renovated system would strengthen downtown marketing opportunities; and failure would deprive the city of revenues from its 10% gross receipts tax.

But, city officials had no interest in development and ownership. Avers' Company, Youngstown Thermal Corporation, was asked to manage as a for-profit venture. Credit for success is attributed to diligence on the part of city officials in organizing the effort, the recommendations of the technical assistance team, establishing and maintaining clear objectives, and strongly supporting the company -- including obtaining approval for system deregulation.

The overall message here seems clear: cities and developers have a mutual interest in salvaging or creating DH systems. Early, honest, and frequent communication can limit inevitable system development complexities, and remove doubts and suspicions.

SESSION 8: Federal Perspectives on DHC Development

Alfred Moran, Assistant Secretary, Department of Housing and Urban Development

Moran stated that, while buying heat has always been a burden for HUD's low income constituents, for the cities involved in Community Development and Action Grant Program (CDBG and UDAG), recognition of the vital role of reliable and reasonably priced energy in economic development has come about more recently. By amending its legislation, Congress emphasized that HUD has a unique program mission that includes energy.

The amendments to Title I of the Housing and Community Development Act of 1974 included a Congressional finding that: "increasing energy costs have seriously undermined the quality and overall effectiveness of local community and housing development activities." They established as an additional objective for the programs: "the conservation of the Nation's scarce energy resources, improvement of energy efficiency, and the provision of alternative and renewable energy sources of supply."

In response to the amendments, HUD Secretary Pierce approved the creation of an Energy Division in the Office of Community Planning and Development and made the Assistant Secretary the Chief Energy Officer for the Department, giving Moran and his staff a key energy coordinating role for HUD.

Energy supply may now be more abundant, he said, but energy costs continue to burden HUD clientele -- especially distressed cities undertaking economic development, and low- and moderate-income families living in public and other HUD assisted housing, as well as in private housing. HUD's energy activities are, therefore, concentrated on ameliorating these conditions.

HUD also is concerned about the impact of energy on its own expenditures. Since the Department spends about $1.5 billion a year for utility costs for both public housing and publicly-assisted housing, it is extremely interested in the retrofit or upgrading of buildings.

HUD is funding over $50 million per year of such retrofit through its CDBG and rental rehabilitation programs, and is beginning a technical assistance program in this area.

On the community and economic development side, the Department is supporting preparation of economic development-related energy strategies, noted by Congress in the Act, amendments, and committee language. Ten communities have received small technical assistance grants to document energy strategies and share them with their neighbors.

The big ticket community and economic development energy emphasis, however, has been on district heating and cooling.

Moran noted that HUD began a major effort in this area in 1981, together with the Department of Energy, by conducting a nationwide competition in which over 100 cities applied. Of these, 28 cities were granted funds to

conduct DHC feasibility studies. Six of those whose studies demonstrated feasibility were later assisted in Phase II design and financial packaging of their systems. Four more communities, not among the original 28, began receiving Phase II assistance in November.

Since HUD is particularly concerned with the potential for economic development that DHC systems provide, it is not surprising that UDAG funds have assisted the major new community systems (Trenton, St. Paul) presently coming into full operation. The fact that UDAG funds are involved means that private funds dominate project financing, in keeping with HUD's emphasis on public/private partnerships in economic development. Moran anticipates that other communities will elect soon to use their CDBG money, perhaps by setting up UDAG-type loan pools, for DHC systems.

Three additional points he made are:

- Because public housing often comprises a large, stable heating load, and because of increasing utility costs borne by HUD, HUD is encouraging tie-ins of district heating to public housing.

- Other potential good heating loads for community systems include military bases and Federal buildings. The Defense Department has declared it policy that new or expanded base energy requirements be considered in conjunction with those of the nearby community when considering third-party contracting for satisfying those requirements. HUD will be seeking similar policy from GSA.

- Burning municipal waste and converting it to energy because of its positive impact on community development, is viewed favorably by HUD and it is providing technical assistance in this important area.

Finally, Moran thanked the Department of Energy and its sponsored laboratories for their cooperation in DHC activities. Their somewhat more technical, exploratory and research approach has, he said, blended well with HUD's more development-oriented one regarding building retrofit, energy strategies and, of course, DHC. DOE is about to fund more Phase I studies while HUD concentrates on Phase II.

Pat Collins, Undersecretary, Department of Energy*

Echoing Moran's comments, Collins expressed his appreciation for the excellent working relationship with HUD on all energy aspects of concern to them -- including the retrofit of buildings for energy efficiency -- and most particularly, DHC.

He noted that DOE's recent RFP for Phase I feasibility studies has drawn almost 100 applications, with results expected to be announced during March.

Collins pointed out that initial DOE/HUD collaboration with the 28 cities provided tremendous bang for the 1.5 million Federal bucks, stimulating private and additional public investments in the hundreds of millions. So, DOE is looking forward to funding more Phase I

*Remarks delivered by John Millhone.

work and is pleased that HUD is able to proceed apace with support of further implementation as it has been doing with its Phase II and UDAG funding. In a short while, some of DOE's present applicants will have proven feasible systems and may be knocking on HUD's door for additional study and UDAG assistance.

Collins acknowledged, too, the strong and very useful aid to DHC provided by the DOE -- and in this case HUD as well -- supported laboratories. Technical assistance provided early on by Argonne and Oak Ridge National Laboratories and Argonne's present aid during Phase II have been invaluable.

From the point of view obtaining technical assistance material of a transferable nature from the projects, Collins asserted that Argonne is in the forefront of such efforts, and that DOE plans to put still more emphasis on information transfer in its program.

One area of great concern to DOE is use of "waste" steam or hot water from electric generating plants for DHC. Cogeneration has numerous advantages in terms of efficiency of fuel usage, reasonably priced energy source for DHC, and alleviating environmental problems related to releasing heat to nearby bodies of water.

Information in the recent DOE report on electrification and from other sources provide ample evidence that almost all electric plants will, in the not too distant future, be hard pressed to meet peak demands. Collins feels that new facilities should be designed to capture thermal energy to assure efficiency and lighten the heavy burden on the rate base that new facilities cause. Retrofit of existing plants, where feasible, is also highly desirable as indicated by the experiences recounted here by Jamestown, New York.

Collins expressed his continued interest in working with HUD energy staff as each department moves into new phases of DHC work.

Report on "District Heating and Cooling in the United States: Prospects and Issues," a report by the National Research Council of the National Academy of Sciences, by David O. Meeker, Chairman

Meeker, Chairman of the NRC Committee that had been working on the district heating and cooling report for over a year, summarized the committee's findings.

The Committee's charge was to determine existing impediments to DHC, recognize and propose ways to remove impediments, and consider the potential of DHC as an economic and community development tool for cities.

Finding that concurrent with the deterioration of urban systems there was a proliferation of institutional scale DHC systems servicing university campuses, hospital complexes, and military bases, the Committee concluded that technology was no barrier. The barriers to community-scale DHC systems include lack of knowledge by the public and policy makers, inappropriate regulation, unfair tax treatment, and overly-restrictive financing requirements on the part of prospective investors. The Committee did not call for giving DHC special treatment; rather, it asked for "a level playing field," i.e., removing the barriers that currently place DHC at a competitive disadvantage vis-à-vis conventional systems. Investor-owned DHC systems, for example, are regulated

by state public utility commissions as if they were a monopoly service similar to electricity, often setting rates, fixing returns on investment, and determining service areas in ways that make them uncompetitive.

Meeker indicated that the Committee's report called for continuation of the HUD and DOE research and demonstration programs which have given community-scale DHC systems a big push in the last few years, including the development of innovative financing and ownership arrangements. Linkage of institutional and community systems -- expansion of existing systems rather than just starting new ones -- could accelerate market penetration, especially where major industrial or institutional customers can serve as an anchor customer.

Seeing lack of data and information in a usable form as a further impediment, the Committee recommended that DOE establish a DHC data base, and that HUD, DOE, and industry and trade groups sponsor workshops and information exchanges for both professionals and policy makers.

The Committee also pointed to the potential for DHC to support community development objectives, and specifically that such systems should consider public housing as potentially one of the biggest clients. All upgrading of public housing should consider tieing into DHC systems.

Finally, while federal support should be expanded, most of the responsibility will fall on state and local governments and to trade associations, for promoting the technology and its application. The federal role is not to create subsidies exclusively for DHC but to promote the use of such more-generally-applicable programs as UDAGs and Community Development Block Grants for such systems. Cities, individually, should decide whether district heating and cooling projects are the best uses of such programs, rather than the federal government.

The Committee report, just published in February, is available by calling (202) 334-3344.

SESSION 9: Mayor's Colloquium

In this session, five mayors spoke of their cities' recent experience with developing DHC systems. All have become enthusiastic DHC supporters, seeing in such systems opportunities to regain some of the competitive positions their cities had lost.

Jamestown, New York's Mayor Steven Carlson led off with a report on a DHC system that had just begun operating in November 1984. Although failing in its bid for HUD support in the 1981 round of Phase I funding, Jamestown chose to go ahead anyway, with financial help from the New York State Energy Research and Development Authority. A subsequent consultant report identified a feasible project, and was endorsed by the Mayor's Ad Hoc Advisory Task Force on District Heating. The result is a pilot project plant in which waste heat from the municipal power now serves a private manufacturer, a 130-bed hospital, and two city garages. Actual savings -- 25-40% in the first month -- exceeded expectations.

Carlson reported that the key go-ahead criterion was economic: the system had to be self-supporting and lower energy costs to users. He counseled against endless studies; if economic feasibility is shown and private support is given, proceed. The benefits to the community are clear.

Like Jamestown, Provo operates a municipal utility. Under these circumstances, argued Mayor James Ferguson, the question is not whether district heating should be built, only how.

In his city, the system now about to begin construction will serve a high school, medical center, office complex, and senior citizen center. Plans are underway to link up with the central business district in the hope of eliminating environmentally poor individual boilers. Also being looked at is a business park near the city's sewage treatment plant.

In sum, says Mayor Ferguson, the linkage of DHC and community/economic development is self-evident. District heating can use UDAGs for leverage, in turn promoting community development objectives. Having a municipal power system is a big asset. Currently, district heating is competing with natural gas; as a result, the gas utility is trying to meet the competition of DHC, which the Mayor believes can only result in community benefits.

Trenton, New Jersey's Mayor Arthur Holland made a special case for the benefits of cogeneration. Seconding Tom Casten's earlier observations, Mayor Holland sees the new system as having tremendous benefits to his city. He expects his city government's energy bills to be cut by $2 million over 20 years and make downtown office building more attractive.

Government support has been crucial. The original DOE grant showed that the project was feasible, and the UDAG was instrumental in securing financing. Finally, he said that European experience with DHC was instructive in showing that DHC was benign, that plants and residences and business can coexist.

A more cautious note was sounded by St. Paul's Mayor George Latimer. Although agreeing strongly that his city's new DHC system would give his city a great economic boost, a certain number of studies were needed to prove

that the investment was sound before a go-ahead decision could be made. Latimer credited DOE and HUD support for getting early work underway. He said several lessons can be drawn from the St. Paul experience:

- Cities have insufficient resources to do their own DHC research; it must continue at the national level.
- Enthusiasm should be tempered with realistic analysis.
- Ownership/operating entity choices should be flexible. Create workable hybrids if necessary.
- UDAGs or other public subsidies are probably necessary to get over startup humps. DHC is a public good that may need public investment.
- The search for expansion opportunities should be continuous; St. Paul is looking to tap an aquifer for cold water storage for summer cooling, and at wood chips from city parks as a fuel source.

The final speaker, Mayor Richard Neal of Springfield, Massachusetts, discussed a project still in the design stage. He reinforced the views of previous speakers in urging continuation of support for both design work and for startup construction, considering the evident public benefits that accrue. Neal pointed to his city's project which, in effect, returns the city to its historical energy roots by tapping the river as a mainstay of its renovation program. DHC, he suggested, is a prime example of public/private cooperation that deserved widespread support by both sectors.

SESSION 11 How to Avoid Mistakes in Managing Your Project (for Phase I Applicants for DOE Awards)

Appropriately, the final session brought together representatives of cities that were far enough along in the analysis and design process to reflect on their experiences for the benefit of those just getting started, particularly those applying to DOE for Phase I funding. (Applications were due in December, awards to be made in March.) The result is a valuable list of lessons that could help avoid early mistakes and allow projects to progress more rapidly. Since speakers reflected on their unique experiences, it is not surprising that some conflicts emerged; more significant, however, is the common theme of maintaining sound leadership and project management and obtaining high-quality advice throughout the project, and the need to retain flexibility in the face of changing conditions and new information.

Provo's Garth Limburg sounded the session's theme by reminding the audience that DHC development is complex, and requires the application of diverse-management skills. His lessons:

- Projects change during the course of study. Be flexible in considering alternative configurations and technologies.

- Project sponsors should retain strong leadership. Consultants should be directed rather than control and decide. If necessary, consultants can and should be replaced.

- Be politically sensitive: authority usually is 20% given and 80% taken. Project leaders should be decisive, and not hang back waiting for decisions to get made.

Sheldon Lynn of Baltimore pointed out that the project leader need not be an engineer -- but must know where to obtain help and how to evaluate results. The main role of the project leader is, ultimately, to bring parties together to negotiate an agreement. A successful project brings together the three basics of: (1) a cheap, competitive heat source such as coal or refuse; (2) a customer base load able to sign long-term purchase contracts; and (3) someone who wants to be in the DHC business. This is no easy task to accomplish.

He drew the following conclusions from Baltimore's experience:

- Get a good consultant who, after solid analysis, can help bring prospective buyers and sellers to the negotiating table. Economic analysis and financing skills are more important than engineering. Be wary of consultants' interest in special approaches, at least in the early feasibility stages. City needs to keep asking whether it is getting good advice.

- Some conditions of HUD (or DOE) funding may not be essential, such as detailed work plans and large assessment work groups. The ultimate test is success, not process; assessment work groups can help, but not all DHC projects need them.

- Consider ultimate project beneficiaries. For example, if local housing authorities are customers, benefits go to HUD, not the local authority.

- Finally, allow for schedule slippage. Delays are inevitable while parties consider making and responding to offers, and as a new idea for many cities, time must be made available for key parties to learn about DHC.

Richard Kuo of New York City's Energy Office expanded on the previous speakers by offering these reflections:

- Be prepared for changes, especially at the policy level. Projects take time and turnover is inevitable.

- Look for "bankable" projects. Wall Street financiers want assurances; they look for solid owner/operators, creditworthy customers, debt sources, and "deep-pocket" backers.

- Get independent financial advice, not tied to particular approaches.

- Try to select a construction contractor and operator as early as possible, ideally even before financing is assured, to add strength to financial negotiations.

- Technical analysis is crucial, but so, too, are legal, tax, regulatory, environmental, and policy questions. A reasonably complete picture should be obtained during Phase I, even if it is superficial.

- Cost-effectiveness means comparing rates to the competition over the term of project financing, being sensitive to possible changes over time. Above all, be realistic about projections to make projects credible to investors.

INDEX OF SESSIONS AND FEATURED CITIES

	2A-Public Housing	2B-Utility Systems	4A-Marketing	4B-Financing	5-Community Development	6A-Waste to Energy	6B-Ownership	7-Private Sector	9-Mayor's Colloquium	11-Avoiding Mistakes
Albany	*									
Baltimore	*					*				*
Chicago			*		*	*		*		
Hartford					*					
Hibbing						*				
Holland			*							
Jamestown		*					*		*	
Lawrence				*		*	*	*		
Lewiston				*						*
New York				*						
Pittsburgh							*			
Provo				*	*				*	*
Rochester		*						*		
St. Louis		*						*		
St. Paul	*								*	
San Francisco		*	*		*					
San Jose							*			
Springfield			*		*	*			*	
Trenton				*				*	*	